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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/402,482	11/09/1999	CHRISTOPH GROHMANN	P18477	6003

7590 01/30/2004

GREENBLUM & BERNSTEIN  
1941 ROLAND CLARKE PLACE  
RESTON, VA 20191

EXAMINER
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KIBLER, VIRGINIA M

ART UNIT	PAPER NUMBER
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2623

DATE MAILED: 01/30/2004

15

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/402,482

Applicant(s)

GROHMANN ET AL.

Examiner

Virginia M Kibler

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 10 November 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 14-37 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 14-37 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. §§ 119 and 120

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
- a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### *Claim Rejections - 35 USC § 102*

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 14-17, 20-22, 27-29, 31-35, and 37 are rejected under 35 U.S.C. 102(e) as being anticipated by Adams (5,583,904).

Regarding claim 14, Adams discloses inspecting at least one test object including an X-ray beam tube 10 having a small field of view in relation to a horizontal extent of an area of the at least one test object to be inspected, and a detector 40 having a small field of view in relation to the horizontal extent of the area of the at least one test object 120 to be inspected, wherein the at least one test object is fixed in a stationary position throughout the inspection, and the X-ray beam tube and detector are linearly moveably arranged within parallel x-y planes for inspection an entire area of the at least one test object (Figure 8; Col. 14, lines 45-67 and Col. 15, lines 1-58).

Regarding claim 15, Adams discloses a carrier 608 adapted to be fixedly mounted throughout the inspection of the test object wherein the carrier is coupled to the test object during inspection (Col. 15, lines 1-9).

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Regarding claim 32, the arguments analogous to those presented above for claims 14 and 15 are applicable to claim 32.

Regarding claim 16, Adams discloses a computing device being coupled to the detector (Col. 15, lines 37-39).

Regarding claims 17, Adams discloses an analysis unit being connected to the computing device (Col. 15, lines 37-39).

Regarding claim 20, Adams discloses the X-ray beam tube and detector are adapted for two-dimensional inspection of the test object (Figure 6).

Regarding claim 21, Adams discloses the X-ray beam tube and detector are adapted for three-dimensional inspection of the test object (Figure 5).

Regarding claim 22, Adams discloses the test object as a printed circuit board (Col. 15, lines 1-4).

Regarding claims 27 and 33, Adams discloses the X-ray beam tube and the detector are adapted to linearly move parallel to each other (Figure 8; Col. 15, lines 48-58).

Regarding claims 28 and 34, Adams discloses the X-ray beam tube and the detector are adapted to linearly move together in a same direction (Figure 8; Col. 15, lines 48-58).

Regarding claims 29 and 35, Adams discloses the X-ray beam tube and the detector are adapted to linearly move in a same direction (Figure 8; Col. 15, lines 48-58).

Regarding claims 31 and 37, Adams discloses the X-ray beam tube and the detector are adapted to linearly move parallel to the at least one test object (Figure 8; Col. 15, lines 48-58).

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***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 18, 19, 23, and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Adams (5,583,904) as applied to claim 14 above, and in further view of Neubauer et al. ("X-Ray Inspection of Solder Joints by Planar Computer Tomography").

Regarding claim 18, Adams does not appear to recognize the X-ray beam tube comprising a microfocus tube with a focal spot diameter of 10 to 40 microns. However, Neubauer et al. ("Neubauer") teaches that is known to use a microfocus tube with a focal spot diameter of 20 microns (Page 64, para. 1). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have modified the X-ray beam tube disclosed by Adams to include a microfocus tube with a focal spot diameter of 20 microns as taught by Neubauer because it is well known in the art and is a matter of design choice.

Regarding claim 19, Adams discloses using a detector similar to charge coupled devices, but does not recognize a detector comprising a CCD chip. However, Neubauer teaches that it is known to use a detector including a camera (Figure 2) which inherently will have a CCD chip arranged on a taper. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have modified the detector disclosed by Adams to include using a camera as taught by Neubauer as an alternative detector because it is a matter of design choice.

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Regarding claims 23 and 24, Adams discloses the device being adapted for X-ray inspection of electrical connections on printed circuit boards (Col. 5, lines 29-31), but does not specify solder joints. However, Neubauer teaches that it is known to inspect solder joints by a fully automated 100% X-ray inspection (Sect. 1). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have modified the electrical connect disclosed by Adams to include solder joints as taught Neubauer because it is routinely implemented in the art in order to detect solder voids, insufficient solder volume and various geometrical deviations from the ideal solder joint.

5. Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Adams (5,583,904) as applied to claim 14 above, and further in view of Armistead (4,852,131).

Regarding claim 25, Adams discloses an analysis unit including analyzing the images in a conventional way to yield data about the quality of the electrical connection on the circuit board (Col. 5, lines 29-31) but does not appear to recognize including a learning mode. However, Armistead teaches that it is known to include a learning mode (Col. 7, lines 43-68) including a set of testing algorithms transmitted to the analysis unit, and the algorithms are used to generate a characteristic vector for an individual solder joint (Col. 6, lines 43-46) that is optimized to statistically represent a defect-free solder joint, wherein the characteristics vector is optimized by analyzing vectors of a same soldered joint on other circuit boards (Figure 11, step 6F).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have modified the analysis of the images disclosed by Adams to include a learning mode as taught by Armistead because it is a well known methodology for defect detection and provides a model of each solder joint for inspection.

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6. Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Adams (5,583,904) and Armistead (4,852,131) as applied to claim 25 above, and further in view of Rooks (5,719,952).

Regarding claim 26, Adams discloses an analysis unit including analyzing the images in a conventional way to yield data about the quality of the electrical connection on the circuit board (Col. 5, lines 29-31) but does not appear to recognize including a testing mode. However, Armistead teaches that it is known to include learned characteristic vectors with tolerances in an inspection (Figure 9, S2) or “testing” mode. Armistead’s testing mode includes component and bond defect vectors or “learned characteristic vectors” (Col. 6, lines 43-46) with tolerances (Col. 6, lines 32-36). To test a soldered joint, the image data comparing computer 61 is used to determine a correlation between the learned characteristic vectors and the soldered joint under test (Col. 8, lines 46-50). Armistead does not recognize the need for a pad image buffer. However, Rooks teaches that it is known to use a frame or “pad image” buffer (Col. 4, line 46). Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to have modified the analysis unit disclosed by Adams to include learned characteristic vectors and a correlation between the learned characteristic vectors and the soldered joint under inspection, as taught by Armistead, and a pad image buffer, as taught by Rooks, because a testing mode is well known in defect detection and providing a pad image buffer provides greater accuracy in the analysis of the solder joint under inspection.

7. Claims 30 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Adams (5,583,904) as applied to claims 27 and 33 above, and further in view of Niklason et al. (5,872,828).

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Regarding claims 30 and 36, Adams does not recognize moving the X-ray beam tube and detector in opposite directions. However, Niklason et al. ("Niklason") teaches that it is known to linearly move the X-ray beam tube and the detector in opposite directions (Figure 1). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have modified the linear movement of the X-ray beam tube and detector disclosed by Adams to include moving them in opposite directions as taught by Niklason as a design choice because it is a well known methodology routinely implemented in the art.

#### ***Response to Arguments***

8. Applicant's arguments, see pages 2-8, filed 11/10/03, with respect to the rejection of claims 14 and 32 under Adams et al. (5,561,696), Niklason, and Annis have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground of rejection is made in view of Adams (5,583,904).

#### ***Other Prior Art Cited***

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Neubauer, "Intelligent X-Ray Inspection for Quality Control of Solder Joints," IEEE, April 1997, pages 111-120.



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***Contact Information***

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Virginia M Kibler whose telephone number is (703) 306-4072.

The examiner can normally be reached on Mon-Thurs 8:00 - 5:30 and every other Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amelia Au can be reached on (703) 308-6604. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 306-0377.

*VK*

VK

1/23/04

MEHRDAD DASTOURI  
PRIMARY EXAMINER

*Mehrdad Dastouri*